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Montana Soil Survey Plan

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Prepared by

STATE SOIL SURVEY ADVISORY COUNCIL

Appointed and Chaired by

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

TED J. DONEY, DIRECTOR

DECEMBER 1980

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LEGISLATIVE MANDATE FOR THE SOIL SURVEY PLAN

The Montana Soil Survey Act (HB 377) passed in 1979 directed the Department of Natural Resources and Conservation to develop and implement a statewide soil survey and mapping program and to suggest sources of funding for such a plan. In order to achieve the goal mandated by the Soil Survey Act, the State Soil Survey Advisory Council was appointed; it was chaired by the Director of the Department of Natural Resources and Conservation. The plan was made according to standards set forth by the National Cooperative Soil Survey program. It identifies equipment, personnel, facilities, supplies, maps, and other material necessary to complete the soil survey. The plan requires funding in the amount of $525,000 per year by the 1981 Legislature to accelerate the proposed program.

INTRODUCTION

Our soils are literally the ground we stand on--an essential element in our lives. Wise use of the varied soils in Montana's 93 million acres requires careful planning, knowledgeable treatment, and protection of their special qualities. Any decision made for soil use will be better if it is based on a sound understanding of that soil's properties and characteristics.

Completion of a statewide survey of Montana's soils is essential to the goal of wise land use. A soil survey involves a series of steps. First, field work is accomplished by soil scientists using augers, temperature and humidity gauges, and other diagnostic tools. The types of soils, their depth, slope, and stability are all tabulated. This data is then recorded on topographic maps--most use aerial photographs as a base.

From this detailed information, land use criteria can be developed. These criteria will consider, among other things, the soil's possible response to different kinds of use; soil surveys can provide data for:

1. Making wise land use decisions that consider soil potentials.

2. Preparing long-range plans for cities, towns, counties, planning boards, ranchers, farmers, foresters, and industrial and residential developers.

3. Selecting sites for structures, highways, reservoirs, and recreation areas.

4. Managing forest, rangeland, cropland, wilderness, and habitat for wildlife.

5. Assuring that soils are put to beneficial uses without risk of damage.

The benefits of the prompt completion of a statewide soil survey are many--chief among them is that comprehensive information for the best use of Montana's land will be available to both individuals and public agencies. State organizations that guide land use planning can use current soil resource information to make sound appraisals. Conservation districts and planning boards will be able to make informed decisions on land use in their areas. Political subdivisions--counties and towns--will have up-to-date information to help in the protection of the environment and its quality, and in the conservation of land and water resources. Soil survey data will also be valuable in the management of state lands.

Individuals in every part of the state need the help that soil surveys can give. Ranchers, farmers, and forest products workers will benefit from the information supplied by current soil surveys. Using this data, a farmer may decide not to plow a certain part of his holdings because the soil survey shows it would be better left in rangeland. Road builders may choose a reroute a section highway to avoid unstable ground. Foresters can decide on techniques suitable for use on vulnerable slopes when planning harvests. Soil surveys form the basis for determining land values for tax purposes in many states and could well be considered for similar use in Montana. The probable uses of the soil survey are as varied as the soils of Montana.

OBJECTIVES OF THE PLAN

The soil survey plan has five objectives; they are to:

1. Complete field mapping and publication of soil surveys for the entire state by 1999.

2. Evaluate all soils in the state for potential uses and problems, and for the means of overcoming limitations.

3. Obtain data on chemical and physical properties of soils.

4. Improve soil resource education for use by land managers, owners, and agencies.

5. Achieve coordination among agencies involved in the Montana Soil Survey Program.

ACHIEVING THE OBJECTIVES

The Council, in setting forth the plan's objectives, has considered what was needed to accomplish them--personnel requirements and duties, costs of equipment, transportation, and salaries. The requirements of each objective are given below.

OBJECTIVE 1. COMPLETE MAPPING BY 1999

To achieve this objective 12 additional full-time soil surveyors are needed, besides the present staff employed by the Soil Conservation Service, as well as 12 vehicles, and allowance for vehicle operating costs. Other support facilities (office space, etc.) can be provided from regular anticipated budgets. The total additional costs are estimated at $260,000 per year in 1980 dollars.

In addition, a scientist knowledgeable in geology, geomorphology, and soil science is required to supervise the field work of student geologists and soil scientists conducting preliminary investigations of new soil survey areas. This person would also participate in quality control reviews with all agencies involved in the Montana Cooperative Soil Survey. Total costs for salaries, transportation, supplies, equipment, and publication expenses are estimated at $40,000 per year.

OBJECTIVE 2. EVALUATE SOIL USE POTENTIALS

This objective will require three professionals to rate soil potentials for:

a. Crop production

b. Forest and range management

c. Urban and recreation uses

The estimated cost for salaries and research program support is $40,000 for each category, or a total of $120,000 per year.

OBJECTIVE 3. OBTAIN DATA ON CHEMICAL AND PHYSICAL PROPERTIES OF SOILS AS NEEDED FOR THE SOIL SURVEY

Adequate data can be obtained for objective 3 by adapting existing facilities and providing for coordination, labor, and supplies. The annual cost is estimated at $50,000.

OBJECTIVE 4. IMPROVE SOIL RESOURCE EDUCATION DELIVERY SYSTEMS FOR MUTUAL USE BY LAND MANAGERS, OWNERS, AND AGENCIES

This objective can be accomplished by incorporating more soil survey data into existing state and federal data systems, such as:

a. Montana AGNET, with terminals in county agricultural offices;

b. The Montana Geodata Information System in the Department of Community Affairs; and

c. Land resources data systems operated by the Forest Service, Soil Conservation Service, Bureau of Land Management, and private agencies.

Work would mesh with that of other state and federal agencies as well as with private users. This objective would require a full-time soil scientist with capabilities in computerized information delivery. In addition, money is needed for computer programing and services. Yearly costs for this objective are estimated at $50,000.

OBJECTIVE 5. ACHIEVE COORDINATION AMONG AGENCIES

Numerous organizations, agencies, and institutions in Montana are responsible for forms of soil inventory or research that contribute to the body of information on Montana soils. Those organizations are listed in the appendix.

Soil resource information must be shared by these agencies and organizations in order to broaden the understanding of such data and its

interpretation, provide timely completion of the statewide soil survey, and make more efficient use of available manpower and funds.

In order to receive the maximum benefit from this broad database, the Council proposes that a clearinghouse be established for coordination of soil survey work among cooperating organizations. The Council or a designated subcommittee would be the logical choice to carry out such activities.

The cooperating organizations would be encouraged to submit periodic reports of their goals for long-term and annual soil surveys or research. Such information then could be exchanged at annual meetings similar to the biennial interagency soil survey conference conducted by the Soil Conservation Service. In addition, more specific survey or research proposals could be directed to the Council or designated subcommittee for review and comment.

The scope of review would be limited to the objectives outlined by the Council in this plan. This review and comment would help the cooperating organizations to avoid duplicating ongoing work, help to fill survey information voids, and enable the Council to achieve the priorities set out in the statewide plan. By offering voluntary review during the planning stages, the Council could assist in coordinating the soil survey in Montana.

The annual cost of bringing agencies' representatives together periodically for coordination activities and for keeping the participants informed is estimated at $5,000.

COSTS OF THE OBJECTIVES

Funds needed on the state level to accomplish the five objectives total $525,000 per year, less than 25 percent of the present annual cost of the soil survey program in Montana. Continuous funding is essential to sustain work on the survey at a consistently productive level. Gaps in funding must be avoided.

FUNDING THE PLAN

Expected initial costs of achieving the stated objectives are approximately $2 million per year. This estimate considers actual dollar needs during 1981 and 1982. Similar resources will be needed throughout the 18-year duration of the project, with appropriate adjustments for inflation and as work is completed.

Federal funding for the program will amount to about $1.5 million dollars. Minor funding will also be available from cooperating counties and private landowners. Approximately $525,000 is needed at the state level each year. At present, no funds are allocated for the program. Financial assistance from the state would contribute greatly to a more rapid completion of up-to-date soil surveys throughout the state. The Council recommends that the state contribute $525,000 per year, to be used according to the objectives.

COSTS/BENEFITS OF SOIL SURVEYS

Completion of the soil surveys can be clearly shown to produce direct monetary gain for the state and subsequent benefits to the people. For a soil survey that will be useful for at least 25 years, the cost/benefit ratio is as much as 125 to 1, or a $5.00 return the first year for each dollar spent, for the entire cost of the survey. The minimum cost/benefit ratio is 45 to 1, or nearly a $2.00 return the first year for each dollar spent for the entire cost of the survey.[1]

CURRENT STATUS

The value of soil surveys made in Montana to date is $56 million in 1980 dollars. Estimated expenditure for soil surveys in 1980 by all cooperators in Montana is $2,040,450. Counties and private industry contributed less than one percent of the 1980 expenditure. Major financial contributors to the soil survey program include:

1. USDA Soil Conservation Service
2. USDA Forest Service
3. USDI Bureau of Land Management
4. Montana Agricultural Experiment Station
5. Old West Regional Commission

IMPROVEMENT OF SOIL INFORMATION DELIVERY

Sharing the information obtained through field research eliminates repetition. Resource inventories, soil classifications, and soil maps can provide widely useful information. Inferences for application to large areas can be made from research results on smaller sites.

The method of making data available to potential users can be improved. An interactive computer network was recently installed in all 50 county extension offices in Montana so that stored information can be shared. A crop management model called FLEXCROP estimates returns on investments based on many factors, including soil, water, and climatic conditions. In addition,

[1]These figures are derived from research done by Jack Rogers, SCS, Bozeman

some 40 interactive programs are available to the public through the AGNET system. Nearly half are related to the soil resource. Figure 1 in the appendix "Computer Assisted Information Delivery," shows the relationships among the database, an integrating concept called "potentials," an interactive computer, the client (planner or farmer), and the land use. Parts of this data delivery system are operational in several states.

Soil resource inventories can be integrated with land use potentials, evaluations, and the decisions made for land use. Several data banks already established can provide the necessary biological, physical, and location data. Alternative management systems can be evaluated in terms of economics, energy efficiency, and effects on the environment. For example, computer-generated maps can identify areas that are similar agriculturally or environmentally, thus promoting the use of research results and the transfer of technology.

Performance data might include, for example, (a) yield of specific crop variety; (b) climatic conditions; and (c) management factors for specific kinds of soil. Similarly, performance data on waste disposal sites, roads, and foundations can be put in terms of the technology and economic investment required on different kinds of soil.

In some cases, the field research has already been done; now the data needs to be assembled. In other cases, the field research will be required for new interpretations and predictions of soil behavior.

THE REMAINING TASKS

High priority in the soil survey plan is being given to soil potential ratings--the ability of the soil, with the application of technology, to yield a certain crop, withstand a certain use, or support a given structure. The rating includes (a) yield or performance level; (b) the difficulty or cost of overcoming or minimizing soil limitations; and (c) the adverse effects or continuing limitations, if any. Soils are rated for a particular use in a geographic area. Soil potential ratings will be made for such uses as agriculture, rangeland, woodland, structures, and recreation. Consideration of the potentials of strip-mined soils and other disturbed soils will be made, as well.

A great deal remains to be done. Over 36 million acres in Montana have not been mapped. Soil potentials and constraints need to be examined. Further, the interpretation of existing surveys to show potentials, possible uses, and hazards has hardly begun. Land has inherent limitations and capabilities that often are not considered when it is put to use. As a result, roads may break up and heave, foundations crack, crops fail to produce. Prime agricultural land is diverted to housing and commercial development. Land better left in range is plowed for crops. Profitable farming and ranching practices often are not put into operation.

Soil scientists need to demonstrate to those who make land-use decisions that each of the several hundred soils recognized in this state has unique properties that affect its usefulness. They also should be able to show that nearly all soil constraints can be mitigated. Some need fairly inexpensive treatment, others may require investments that could be prohibitive, but all land should be regarded as valuable, and cared for accordingly.

APPENDIX A.

SOIL SURVEYS

TABLES

1. Soil Survey in Montana (acres)

2. Survey Status (acres)

3. Conservation Needs Inventory (acres)

4. Published Soil Surveys

5. Completed Soil Surveys Being Published

6. Active Soil Survey Programs

7. National Forests in Montana

APPENDIX B.

COOPERATING ORGANIZATIONS

APPENDIX C.

FIGURE 1. Computer-assisted Information Delivery

FIGURE 2. Soil Survey Map

APPENDIX A

The following tables show what has been done so far in Montana, and what remains to be done.

Table 1. Soil Survey in Montana (acres)[1]

Surveyed to date	56,500,000
Acres remaining	36,589,000
Total	93,089,000

[1]Percent completed to date is approximately 62 percent.

Table 2. Survey Status (acres)

Number Published	14	16,778,901
Number Completed--Not Published	8	16,735,966
Number in Progress	10	29,973,430

Table 3. Conservation Needs Inventory (acres)

Federal Land	26,569,755
Nonfederal land	65,518,178
Urban land	817,940
Water	183,450

Table 4. Published Soil Surveys (numbers refer to areas shown in figure 2 of the appendix)

Big Horn County (607)	3,042,595
Bitterroot Valley area (parts of Ravalli and Missoula counties) (645)	533,760
Broadwater County area (609)	539,111

Table 4. (continued)

Carbon County area (611)	1,072,247
Dawson County (201)	1,509,120
Glacier County and part of Pondera County (600)	1,709,408
Judith Basin County area (602)	897,980
Powder River County area (Powder River County and part of Rosebud County) (643)	2,304,760
Sheridan County (091)	1,088,000
Stillwater County area (655)	957,440
Treasure County (103)	629,760
Upper Flathead Valley area (617)	239,360
Wibaux County (109)	568,960
Yellowstone County (111)	1,686,400
TOTAL	16,778,901

Table 5. Completed Soil Surveys Being Published (numbers refer to areas shown in figure 2 of the appendix)

Blaine County and part of Phillips County (608)	2,846,328
Cascade County area (613)	1,527,071
Fergus County (027)	2,716,160
McCone County (055)	1,660,160
Richland County (083)	1,321,600
Roosevelt and Daniels counties (661)	2,449,920
St. Regis-Ninemile area (Mineral and part of Missoula counties) (603) (FS)	1,039,687
Valley County (105)	3,175,050
TOTAL	16,735,966

Table 6. Active Soil Survey Programs (numbers refer to areas shown in figure 2 of the appendix)

Carter and Fallon counties (660)	3,165,440
Choteau-Conrad area--parts of Teton and Pondera counties (657)	2,015,723
Chouteau County (015)	2,508,800
Custer and Prairie counties (662)	3,514,880
Lake County area (629)	731,975
Lewis and Clark County area (630)	1,288,258
Madison County area (636)	1,556,880
Missoula County area (638)	1,292,307
Rosebud County area and part of Big Horn County (649)	3,297,949
Upper Clark Fork River area--parts of Granite, Powell, and Deer Lodge counties (644)	1,601,218
TOTAL	20,973,430

Table 7. National Forests in Montana

National Forests	Gross Acres Within National Forest Boundaries	National Forest System Land (Acres)	Completed Land-System Inventory (Order 3)[1] Estimated Acres
Beaverhead	2,197,282	2,119,537	2,197,282
Bitterroot	1,188,091	1,113,669	400,000
Custer	1,200,370	1,112,098	700,370
Deer Lodge	1,354,987	1,195,670	550,000
Flathead	2,628,342	2,349,410	2,278,340
Gallatin	2,150,713	1,734,887	1,613,034
Helena	1,159,339	972,408	1,159,339

Table 7. (continued)

National Forests	Gross Acres Within National Forest Boundaries	National Forest System Lands (Acres)	Completed Land-System Inventory (Order 3)[1] Estimated Acres
Kaniksu	491,859	446,956	
Kootenai	2,098,002	1,779,204	2,098,002
Lewis and Clark	2,001,695	1,835,264	2,001,695
Lolo	2,614,849	2,091,422	1,664,049
TOTALS	19,085,529	16,750,534	14,665,111

[1]In the system of land inventory, order 3 indicates a low level of of intensity, or a general undetailed survey.

NOTE: 210,000 acres of Classified State Forest Land in Montana have been mapped by land type, using standards similar to those for the national forest.

APPENIX B. COOPERATING ORGANIZATIONS

ORGANIZATIONS INVOLVED IN SOIL SURVEY ACTIVITIES IN MONTANA

USDA Soil Conservation Service
P.O. Box 970
Bozeman, MT 59715

USFS - Region 1
P.O. Box 7669
Missoula, MT 59807

Bureau of Land Management
P.O. Box 30157
Billings, MT 59107

US Fish & Wildlife Service
316 North 26th Street
Billings, MT 59101

Water and Power Resources Service
P.O. Box 2553
Billings, MT 59107

USDA - Forest Service
Intermountain Forest and
Range Experiment Station
Drawer G
Missoula, MT 59806

Bureau of Indian Affairs
316 North 26th Street
Billings, MT 59101

Northern Plains Soil and
Water Research Center
P.O. Box 1109
Sidney, MT 59270

Department of Natural Resources
and Conservation
Capitol Station
32 S. Ewing
Helena, MT 59620

School of Forestry
University of Montana
Missoula, MT 59812

Burlington Northern Inc.
700 South Avenue West
Missoula, MT 59801

Champion Timberlands
P.O. Box 8
Milltown, MT 59851

Department of State Lands
Capitol Station
Helena, MT 59601

Department of Agriculture
Capitol Station
Helena, MT 59601

Conservation Districts Division
DNRC
32 S. Ewing
Helena, MT 59601

Forestry Division - DNRC
2705 Spurgin Road
Missoula, MT 59801

Montana Bureau of Mines and Geology
Montana Tech
Butte, MT 59701

Department of Community Affairs
Capitol Station
Helena, MT 59601

Agricultural Experiment Station
Montana State University
Bozeman, MT 59717

Cooperative Extension Service
Montana State University
Bozeman, MT 59717

Department of Plant and Soil Science
Montana State University
Bozeman, MT 59717

Montana Forest and Conservation
Experiment Station
School of Forestry
University of Montana
Missoula, MT 59812

St. Regis Paper Company
P.O. Box VX
Libby, MT 59923

APPENDIX C

Figure 1. Computer-assisted Information Delivery (schematic)

Figure 2. Soil Survey Areas

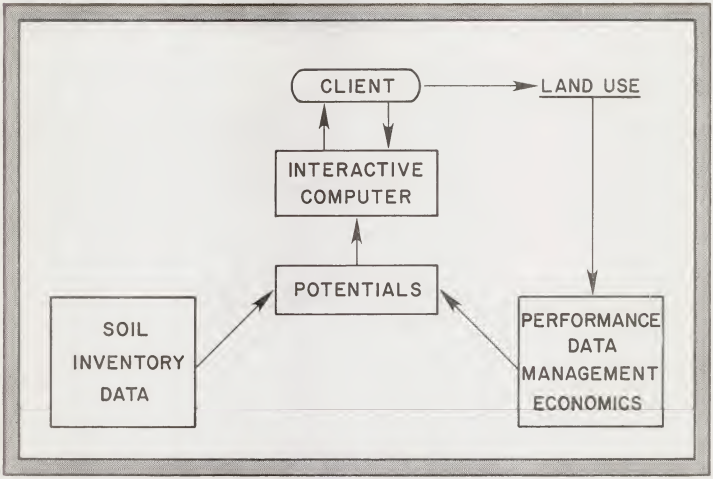
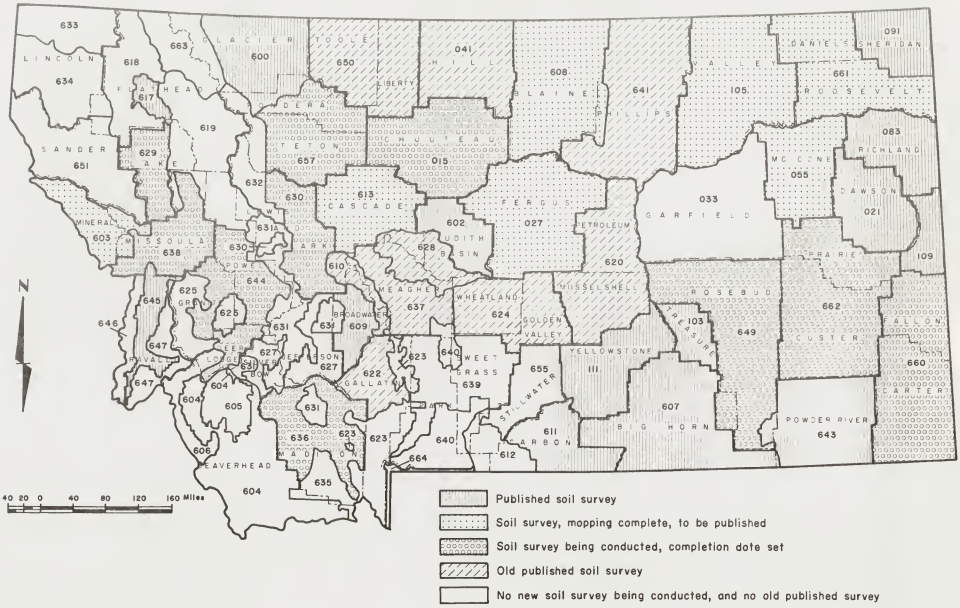


FIGURE I. COMPUTER ASSISTED INFORMATION DELIVERY

FIGURE 2. SOIL SURVEY AREAS


N
40 20 0 40 80 120 160 Miles
Published soil survey
Soil survey, mapping complete, to be published
Soil survey being conducted, completion date set
Old published soil survey
No new soil survey being conducted, and no old published survey